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A3H H7 H8

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US 5129220 A US 5125225 A

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UK CL (Edition L) A3H H7 H8
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(54) Hollow rope chain

(57) A link for a fine jewelry rope chain comprises a link-shaped length of hollow link wire having one or more straight portions of symmetrical cross-section, and a high luster diamond cut planar surface (18) formed on the straight portions of the link-shaped length of wire.

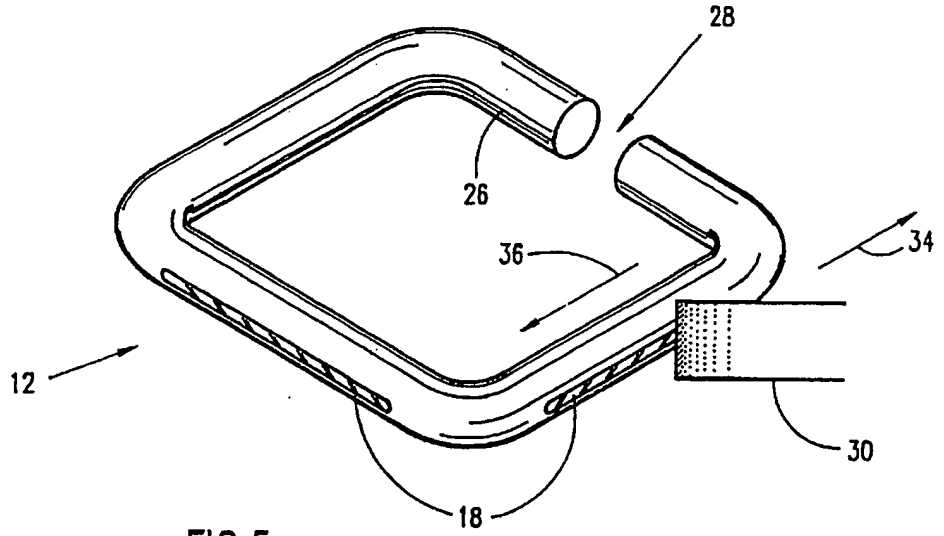

FIG.5

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

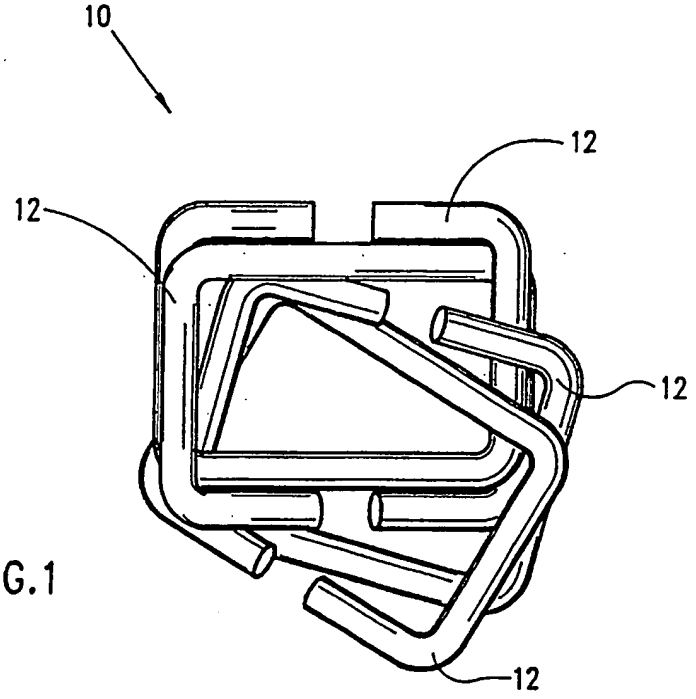


FIG.1

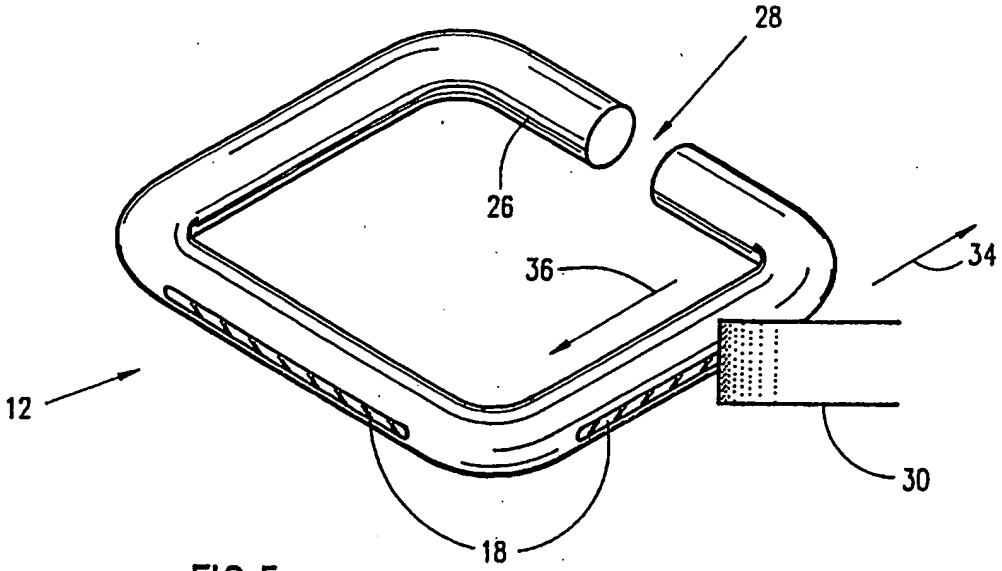


FIG.5

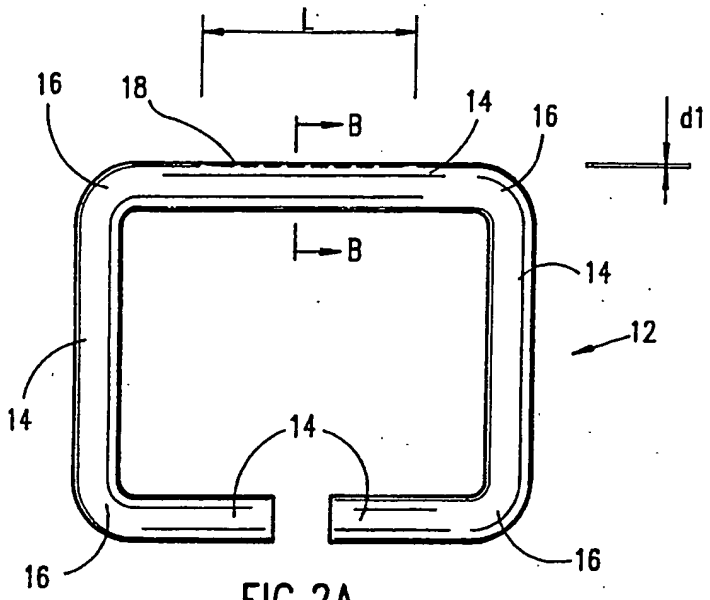


FIG.2A

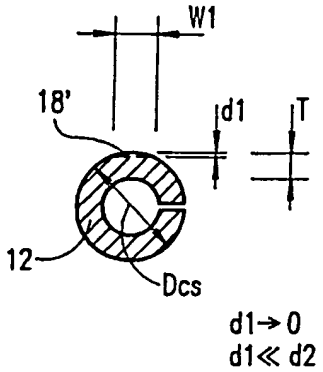
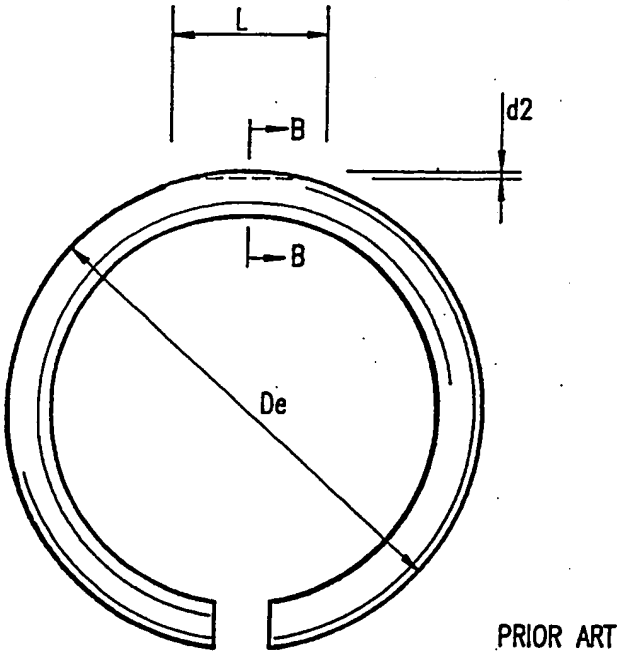


FIG.2B



PRIOR ART

FIG.3A

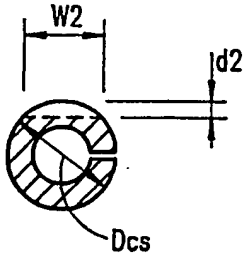


FIG.3B

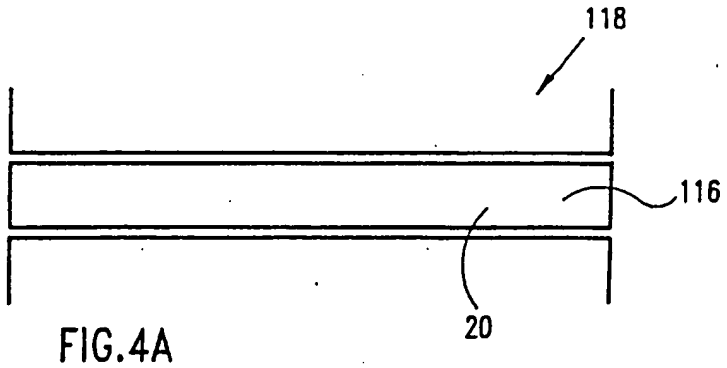


FIG.4A

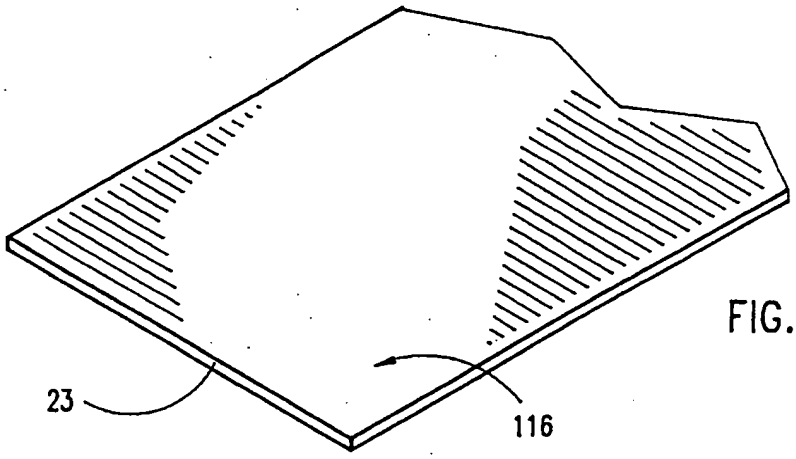


FIG.4B

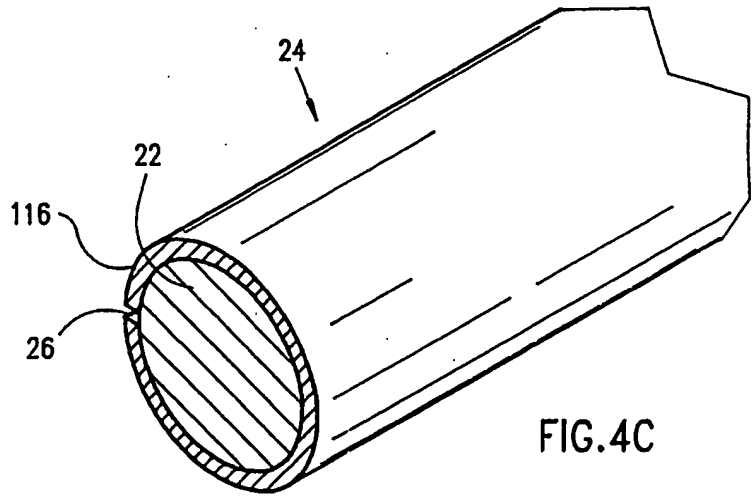


FIG.4C

FIG.6

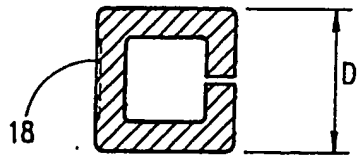
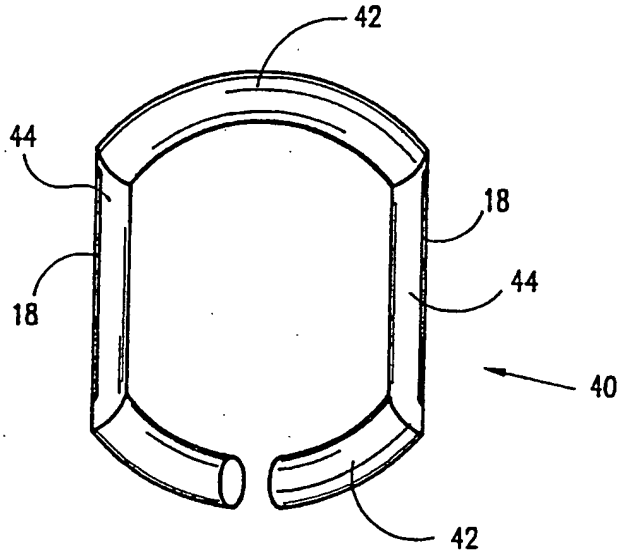


FIG.7



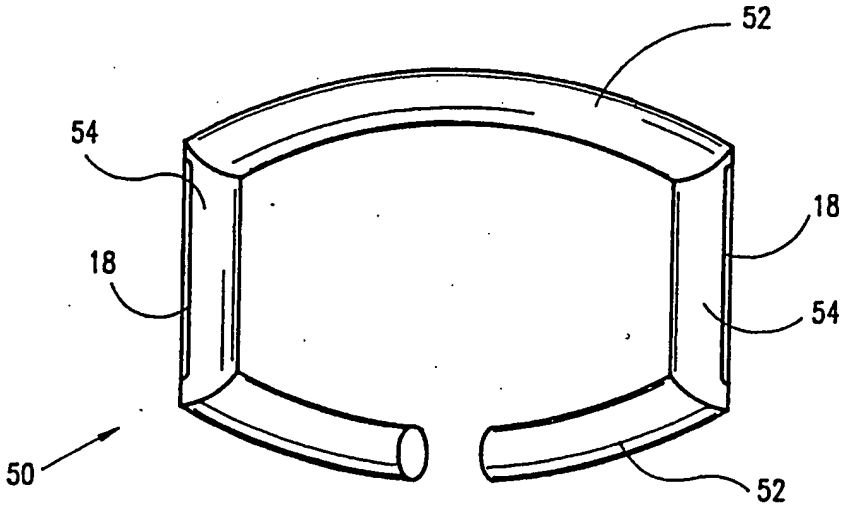


FIG.8

LINK FOR FINE JEWELRY ROPE CHAIN, A FINE JEWELRY ROPE CHAIN AND METHOD OF MANUFACTURE THEREOF

FIELD OF THE INVENTION

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The present invention relates to fine jewelry diamond cut rope chains and to methods of manufacture thereof.

BACKGROUND OF THE INVENTION

Fine jewelry rope chains are well known. In US Patents Nos. 4,934,135 and 4,996,835, there are disclosed rope chains and methods for preparing such rope chains having reduced weight and labor costs compared with conventional rope chains of the same chain diameter.

In the field of rope chains there are known both solid rope chains and hollow rope chains. A solid rope chain is a rope chain whose links are made from solid portions of metal, while a hollow rope chain is a rope chain whose links are hollow. While the general appearance of a rope chain is not affected by the links thereof being specifically solid or hollow, the amount of precious metal used in a hollow rope chain is significantly less than the amount of precious metal used in a solid rope chain of a given size of the same size. Accordingly, a hollow rope chain of a given size is significantly cheaper than a solid rope chain of the same size.

A particularly popular type of rope chain is a diamond cut rope chain. Such a chain includes flat cuts or facets on the outer perimeter of at least some of the chain links to provide a high luster finish so as to make the chain sparkle. Diamond cut facets are known to be formed on solid rope chains by cutting or shaving a layer of predetermined thickness from a curved section of the links.

Solid diamond cut rope chains have facets generally cut about one third or more into the thickness of the chain link in order to obtain a high luster surface of a minimum desired area. In this case, the amount of precious metal sheared away can be as much as 10% of the weight of the chain and although the metal shearings are collected and recycled, a significant amount of precious metal is nevertheless lost in the process.

Although it is known to form diamond cut facets on hollow rope chains, this presents certain problems due to the relative thinness of the outer wall of the hollow links used. In some cases the outer wall may be as thin as 0.05 mm. Accordingly, the forming of a facet on a hollow link in the way in which facets are formed on a solid link would at least cause severe weakening of the outer wall of the link and would probably make a hole therein.

In US Patent No. 5,125,225 to Strobel, there is described the making of hollow rope chains. The method involves wrapping a hollow rope chain about a lathe drum, freezing the drum, applying water to the chain and

immobilizing it by freezing, and flattening portions of the curved outer wall.

The flattened portions of the outer walls are then diamond cut to remove or shave off a very thin layer of metal (about 0.001 to 0.002 mm) to provide smooth and shiny facets without making a hole in the link. The cross-section of the faceted area is deformed with respect to the cross-section of the rest of the chain link.

A disadvantage of the above-described method to Strobel is that as only a very thin layer of metal is shaved from the flattened portions, any substantial dents introduced into the surface by the thrusts of the burnishing tool will remain even after diamond cutting of the facets. Accordingly, great control is required in the flattening of the portions whereat facets are to be formed.

A further disadvantage in the method of Strobel is that it is a relatively complicated process involving a plurality of additional steps as compared with other methods, thereby increasing the relative cost of producing a diamond cut rope chain by this method.

SUMMARY OF THE INVENTION

The present invention seeks to provide a diamond cut hollow link and a rope chain assembled therefrom, that is easier and less expensive to produce than diamond cut hollow link rope chains known in the art.

The present invention further seeks to provide hollow diamond cut links for a fine jewelry diamond cut rope chain, and a rope chain formed of such links, wherein the links are of circular cross-section, and have one or more straight portions on which are formed diamond cut high luster surfaces.

The present invention seeks to provide in addition a method of manufacturing fine jewelry hollow chain links having high luster diamond cut surfaces without deforming the hollow link wire.

There is thus provided, in accordance with a preferred embodiment of the invention, a link for a fine jewelry rope chain which includes a link-shaped length of hollow link wire having one or more straight portions of symmetrical cross-section, and a high luster diamond cut planar surface formed on the straight portions of the link-shaped length of wire.

Additionally in accordance with a preferred embodiment of the invention, the straight portions have a curved cross-sectional configuration.

Further in accordance with a preferred embodiment of the invention, each of the straight portions

has at least one flat surface and the high luster surface is formed thereon.

Additionally in accordance with a preferred embodiment of the invention, the depth of cut into the surface of the link in order to form the high luster surface is in the range 0.001 - 0.01 mm, but preferably does not exceed 0.001 mm.

In accordance with additional embodiment of the invention, there is also provided a fine jewelry rope chain having an assembly of links each of which is substantially as described above.

In accordance with yet a further embodiment of the invention, there is provided a method of manufacturing a diamond cut high luster link for a rope chain including the steps of

providing a length of generally planar metal link wire,

forming the link wire into the shape of a link having one or more straight portions of symmetrical cross-section, and

diamond cutting the straight portion so as to form thereon a high luster surface thereon without substantially cutting into the elongate base.

Additionally in accordance with the method of the invention, the step of forming includes the step of forming the link wire into the shape of a link having one ore more straight portions, each having a curved, preferably circular, cross-sectional configuration.

Further in accordance with the method of the invention, the step of forming the link wire includes forming the link wire into the shape of a link having one or more straight portion shaving at least one generally flat surface and wherein the step of diamond cutting includes the step of diamond cutting a high luster surface on the generally flat surface.

Additionally in accordance with the method of the invention, the step of diamond cutting the straight portion includes the step of cutting into an exterior surface thereof to a preselected cut depth in the range 0.001 - 0.01 mm, but preferably not exceeding 0.001 mm.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood and appreciated from the following detailed description, taken in conjunction with the drawings, in which:

Fig. 1 is a magnified pictorial illustration of a portion of a rope chain manufactured in accordance with a preferred embodiment of the present invention;

Figs. 2A and 2B are respective plan and sectional illustrations of an uncut link of the present invention;

Figs. 3A and 3B are respective plan and sectional illustrations of a prior art circular link of the same general size as the link of Figs. 2A and 2B;

Fig. 4A is a schematic illustration of forming a metal plate for use as a link in the rope chain of Fig. 1;

Fig. 4B is a schematic illustration of a portion of the metal plate of Fig. 4A prior to folding thereof about its longitudinal axis into a cylindrical shape;

Fig. 4C is a schematic illustration of the cylindrical link member formed by folding the metal plate of Fig. 4B about its longitudinal axis;

Fig. 5 is a schematic illustration of diamond cutting of a high luster surface on a straight portion of a link similar to that illustrated in Figs. 2A and 2B;

Fig. 6 is a cross-sectional illustration of a hollow link in accordance with an alternative embodiment of the invention; and

Figs. 7 and 8 are pictorial illustrations of truncated circular and elliptical links respectively.

DETAILED DESCRIPTION OF THE INVENTION

Reference is made to Fig. 1, in which is illustrated a portion, referenced generally 10, of a rope chain. The rope chain is made up of a repeating pattern of links 12 made of a precious metal, such as gold, interlinking so as to form a continuous chain of links in the style known as a 'rope' chain. Accordingly, an entire chain is represented by the plurality of links illustrated in Fig. 1.

Referring now also to Figs. 2A and 2B, each link 12 is formed of a predetermined length of link wire which has a plurality of straight portions 14 typically interspersed with rounded or curved portions 16. As seen in Fig. 2B, the link wire is hollow and, in accordance with the present embodiment of the invention, at least straight portions 14, but preferably also curved portions 16, have a symmetrical, curved or rounded cross-sectional configuration. Preferably, the cross-sectional configuration of the link wire is generally circular. Diamond cut high luster surfaces 18 (Fig. 5), whose location in Fig. 2A is indicated by broken lines 18, are provided on one or more of the straight portions 14.

In accordance with alternative embodiments of the invention, the cross-sectional configuration of straight portions 14 of link 12, while remaining symmetrical, can be any suitable non-round shape, such as the square shape illustrated in Fig. 6.

It will be appreciated that, due to the formation of the high luster surfaces 18 on straight

portions 14 of the link 12, there may be provided a high luster surface whose surface area is at least one-and-a-half times the surface area of a planar diamond cut surface formed on a round or circular link of the prior art of similar overall dimensions. This will become apparent from the ensuing description of Figs. 2A-3B.

As seen in Figs. 2A and 2B, formation of a planar elongate high luster surface 18 on straight portion 14 of link 12 requires cutting into the link wire to a minimal depth 'd1'.

As shown in Figs. 3A and 3B, however, formation of a planar high luster surface on a prior art curved link member requires cutting into the link wire to a significant depth, shown as d2. As seen in the drawings, and as exemplified hereinbelow in an example, cut depth d1 of the present invention is significantly smaller than cut depth d2 of the prior art but provides a high luster surface of much greater area than that provided in the prior art.

In fact, in the case of a circular link of the prior art, in order to obtain a sufficiently large high luster surface, the cut depth d2 may need to be as much as one third of the wall thickness of the link. Not only is this wasteful of material, thereby increasing the manufacturing cost, but the area of the high luster surface is necessarily limited by the cut depth and the curvature of the link.

By way of example, a prior art circular link and a link of the present invention are compared below, wherein the dimensions of the links are as follows:

lateral dimension in elevation De - 5.00 mm,

cross-sectional diameter Dcs - 1.00 mm,

wall thickness T - 0.05 mm.

Referring now to Figs. 2A and 2B, a mathematical expression giving the area A of a high luster surface of width W1 and length L is as follows:

$$A = L \times W1,$$

such that $A = 2L(d1.Dcs - d1^2)^{1/2}$,

wherein L is the lateral dimension De of the link, i.e. 5 mm in the present example, and d1 is a minimal cut depth of, say, 0.001 mm.

Accordingly, in the present example, area $A = 0.316mm^2$.

In the prior art example of Figs. 3A and 3B, wherein

$$A = L \times W2,$$

such that $A = 4(d2De - d2^2)^{1/2}(d2Dcs - d2^2)^{1/2}$

wherein d2 is a maximum cut depth of 0.02 mm (representing a cut of two-fifths into the wall thickness of the link).

Accordingly, in the prior art example,

area $A = 0.177mm^2$

It will thus be appreciated that making a minimal cut depth of 0.001 mm into the link surface in accordance with the present invention provides a high

luster surface having an area 1.75 times as large as the surface provided in the prior art by making a cut depth of 0.02 mm into a link having a wall thickness of 0.05 mm.

As known to persons skilled in the art, the prior art example wherein the cut depth represents 40% of the link wall thickness is an extreme example, as this weakens the link significantly and represents a great waste of valuable precious metal. Generally, the cut depth is far less than this and the high luster surface area is reduced correspondingly.

It will further be appreciated that it is possible to greatly increase the cut depth of 0.001 mm, say, to 0.01 mm, so as to achieve, in the present example, a high luster surface area of 0.995 mm^2. This represents a 5.6 times increase on the prior art example, while still only cutting one-fifth into the link wall thickness.

According to a preferred embodiment of the invention, so as to minimize the material waste in diamond cutting a link in accordance with the present invention, it is preferred not to exceed a cut depth in the range 0.001 - 0.01 mm. Most preferably, however, the cut depth will not exceed 0.001 mm. As described above, even with a cut depth of 0.001 mm, the results are very favorable when compared with the prior art, both from the increase in the area of the high luster surface provided, and in the much smaller amount of material removed and wasted.

Referring now to Figs. 4A-4C, there are illustrated various stages in the manufacture of links 12

referenced 16, is fed through a rolling mill 18, thereby to provide a rectangular strip 20, illustrated schematically in Fig. 4B.

Referring now also to Fig. 4C, strip 16 is subsequently drawn through a die (not shown) together with a soft metal wire core 22, to produce a precious metal plated wire 24, preferably of a circular cross-sectional configuration.

The width of the strip 16 is generally 15-20% smaller than the circumference of the soft metal core 22, thereby producing a gap 26 in the precious metal envelope covering the core 22 along the entire length of the wire 24. The purpose of gap 26 is to provide a large surface area for acid to come in contact with the soft metal core 22 and dissolve it, leaving a hollow precious metal wire.

Referring now also to Fig. 5, chain links 12 are prepared from wire 24 by winding it into a coil and cutting the wire before each complete turn, thereby forming a quasi-helical link with an opening 28.

In accordance with the present invention wherein links 12 are not circular but, rather, have straight portions 14 interspersed with curved portions 16, link wire 24 is wound about a former (not shown) having a cross-sectional configuration selected to impart the desired configuration to the link wire 24.

The links produced, as described, are slightly flattened so as to become unskewed ready for use in assembling a rope chain. The opening 28 is slightly larger than the outer diameter of the link wire, so that one link can be fitted into another via the opening 28. The links are then immersed in a suitable acid so as to dissolve the soft metal core 22 leaving the hollow chain link 12 as shown in Fig. 5.

As shown in Fig. 5, a diamond cutting tool, shown schematically at 30, is used to cut one or more high luster surfaces 32 on the straight portions 14 of link 12. The direction of relative motion between cutting tool 30 and link 12, required to form a surface 18, is indicated by arrows 34 and 36.

Referring now briefly to Fig. 6, there is shown a section of a link having a generally square configuration. A high luster surface 18 is shown as having been formed on a planar surface thereof. It will be appreciated that it is advantageous to diamond cut to a minimal depth of say, 0.001 mm so as to produce a high luster surface that exceeds the equivalent high luster area provided on a curved surface of similar lateral dimension D, and that the advantage is realized two-fold when the link 12 of Fig. 2A is provided with the present, square cross-sectional configuration rather than the round configuration illustrated in Fig. 2B.

Referring now briefly to Figs. 7 and 8, it is seen that links of the present invention can be formed

with substantially any suitable configuration having a straight portion.

By way of non-limiting examples, Fig. 7 shows a link 40 in the form of a truncated circle, having a pair of curved circular portions 42 between which is a pair of straight portions 44 on which are provided high luster surfaces 18; and Fig. 8 shows a link 50 in the form of a truncated ellipse, having a pair of curved circular portions 52 between which is a pair of straight portions 54 on which are provided high luster surfaces 18.

It will be appreciated by persons skilled in the art that, in addition to the advantages outlined hereinabove, a further advantage of the present invention is that, as opposed to the prior art, the formation of high luster surfaces 32 by cutting to a minimal depth of no more than about 0.001 mm, which, in the present example, represents no more than about one-fiftieth of the wall thickness, does not weaken the link and does not require precautions to be taken so as to prevent such weakening from occurring during diamond cutting of the high luster surfaces.

Accordingly, a major benefit from the formation of diamond cut high luster surfaces by a minimal cutting into the wall of a hollow link is that the wall thickness of the link can be minimal.

Further benefits are that even with a minimal cut depth, the high luster surface area of the link of the present invention is approximately doubled when compared with a high luster surface attainable with the link of the

prior art; the method of the invention has fewer steps when compared with a prior art method such as that described in US 5,125,225 to Strobel, and, accordingly, the production of a rope chain in accordance with the present invention is simpler and less expensive than production of a similar sized rope chain in accordance with the prior art.

It will be appreciated by persons skilled in the art that the scope of the present invention is not limited by what has been shown and described above, merely by way of example. The scope of the present invention is limited, rather, solely by the claims which follow.

CLAIMS

1. A link for a fine jewelry rope chain which comprises:

a link-shaped length of hollow link wire having at least one straight portion of symmetrical cross-section, and

a high luster diamond cut planar surface formed on said at least one straight portion of said link-shaped length of wire.

2. A link according to claim 1, and wherein said at least one straight portion has a curved cross-sectional configuration.

3. A link according to claim 1, and wherein said at least one straight portion has a generally circular cross-sectional configuration.

4. A link according to claim 1, and wherein said at least one straight portion has at least one flat surface and said high luster surface is formed thereon.

5. A link according to claim 1, and wherein the depth of cut into the surface of said link in order to form said high luster surface is in the range 0.001 - 0.01 mm.

6. A link according to claim 1, and wherein the depth of cut into the surface of said link in order to form said high luster surface is no greater than approximately 0.001 mm.

7. A link according to claim 1, and wherein said link-shaped length of hollow link wire also has at least one curved portion.

8. A fine jewelry rope chain having an assembly of links each of which comprises:

a link-shaped length of hollow link wire having at least one straight portion of symmetrical cross-section, and

a high luster diamond cut planar surface formed on said at least one straight portion of said link-shaped length of wire.

9. A fine jewelry rope chain according to claim 8, and wherein said at least one straight portion has a curved cross-sectional configuration.

10. A fine jewelry rope chain according to claim 8, and wherein said at least one straight portion has a generally circular cross-sectional configuration.

11. A fine jewelry rope chain according to claim 8, and wherein said at least one straight portion has at

least one flat surface and said high luster surface is formed thereon.

12. A fine jewelry rope chain according to claim 8, and wherein the depth of cut into the surface of said link in order to form said high luster surface is in the range 0.001 – 0.01 mm.

13. A fine jewelry rope chain according to claim 8, and wherein the depth of cut into the surface of said link in order to form said high luster surface is no greater than approximately 0.001 mm.

14. A fine jewelry rope chain according to claim 8, and wherein said link-shaped length of hollow link wire also has at least one curved portion.

15. A method of manufacturing a diamond cut high luster link for a rope chain comprising:

providing a length of generally planar metal link wire,

forming the link wire into the shape of a link having at least one straight portion of symmetrical cross-section, and

diamond cutting the straight portion so as to form thereon a high luster surface thereon without substantially cutting into the elongate base.

16. A method according to claim 15, and wherein said step of forming comprises the step of forming the link wire into the shape of a link having at least one straight portion having a curved cross-sectional configuration.

17. A method according to claim 15, and wherein step of forming the link wire comprises forming the link wire into the shape of a link having at least one straight portion having a generally circular cross-sectional configuration.

18. A method according to claim 15, and wherein said step of forming the link wire comprises forming the link wire into the shape of a link having at least one straight portion having at least one generally flat surface and wherein said step of diamond cutting comprises the step of diamond cutting a high luster surface on the generally flat surface.

19. A method according to claim 15, and wherein said step of diamond cutting the straight portion comprises the step of cutting into an exterior surface thereof to a preselected cut depth in the range 0.001 - 0.01 mm.

20. A method according to claim 15, and wherein said step of diamond cutting the straight portion comprises the step of cutting into an exterior surface thereof to a

preselected cut depth no greater than approximately 0.001 mm.

21. A method according to claim 15, and wherein said step of forming the link wire comprises the additional step of also providing at least one curved portion to the link wire.

22. A method according to claim 9, and wherein said step of diamond cutting comprises the step of forming a planar high luster surface.

I :ents Act 1977 **Examiner's report to the Comptroller under Section 17 (The Search Report)** 22	Application number GB 9314793.2

Relevant Technical fields

(i) UK Cl (Edition L) A3H: H7, H8

(ii) Int Cl (Edition 5) A44C 11/00; B21L 11/00

Search Examiner

MISS D DAVIES

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

24 AUGUST 1993

Documents considered relevant following a search in respect of claims 1-22

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	US 5129220 A (K STROBEL) in particular column 6 line 57 to column 7 line 10, column 11 lines 8-10 and Figure 10 and 10A	1-22
&	US 5125225 A (K STROBEL)	

Category	Identity of document and relevant passages 23	Relev to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

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